(12) UK Patent Application (19) GB (11) 2 265 959 (13) A

(43) Date of A publication 13.10.1993

(21) Application No 9207200.8

(22) Date of filing 01.04.1992

(51) INT CL5
F15D 1/02, F02M 55/02, F16L 9/12 11/12 55/033 55/045 59/14

(52) UK CL (Edition L)
F2P PC1 PF4 PF5 P1A36 P1B7B P1B7F
U1S S1883

(56) Documents cited
GB 1292810 A GB 1076819 A GB 1031396 A
EP 0154104 A WO 84/04574 A1

(58) Field of search
UK CL (Edition K) F2P PC1 PC3 PC9 PF10 PF23 PF30 PF4 PF5
INT CL5 F15D 1/02, F16L 9/12 11/12 55/02 55/04
Online databases: WPI

(71) Applicant
Ford Motor Company Limited
(Incorporated in the United Kingdom)
Eagle Way, Brentwood, Essex, CM13 3BW, United Kingdom

(72) Inventor
Ronald Pardy

(74) Agent and/or Address for Service
A Messulam & Co
24 Broadway, Leigh-on-Sea, Essex, SS9 1BN, United Kingdom

(54) A fuel pipe

(57) A fuel pipe has an inner tube 32a of non-circular cross-section surrounded by a sheath 34. Fuel flows through the inner tube and any pressure fluctuations in the inner tube result in a flexing of the tube walls to approach more closely to a circular configuration. When the tube walls flex, deformation of the sheath 34 takes place to absorb energy and to prevent the pressure pulse from producing noise. The sheath may be of foam rubber co-extruded with a tube of nylon. The cross-section of the tube may be triangular as shown, tri-lobal (Fig. 3 not shown) or flat (Fig. 4 not shown).

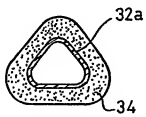

Fig. 2

GB 2 265 959 A

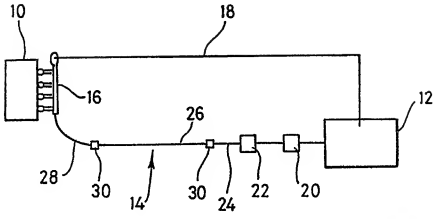

Fig.1

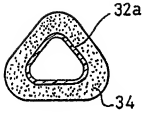

Fig. 2

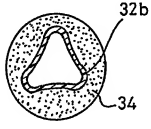

Fig.3

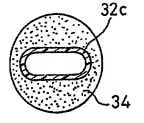

Fig.4

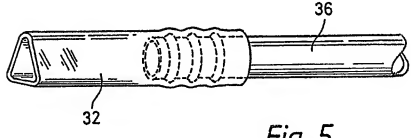

Fig. 5

2265959

A Fuel Pipe

Fuel pipes are used to provide a passage for fuel from the fuel tank to the engine of a motor vehicle. Particularly in engines which use fuel injection, the fuel passing along the fuel line is subjected to pressure pulses which are the result of the rapid opening and closing of the fuel injectors. These pressure pulses produce undesirable noise from the fuel system.

It is known to include a pressure surge damper in the fuel line; such dampers conventionally taking the form of a chamber branched off from the fuel line and containing a diaphragm which separates a closed air space from fuel. When a pressure surge occurs, the diaphragm is forced into the air space and the air is compressed to absorb the energy of the pressure pulse without producing noise. A damper of this type is vulnerable to damage because it sits externally of the fuel line.

According to the present invention, there is provided a fuel pipe for providing a fuel passage between a fuel tank and a fuel-consuming engine, the pipe comprising an extruded length of flexible plastics tube having a non-circular cross-section.

Preferably the tube is surrounded by a rubber or rubber-like sheath which is in contact with the external tube wall. The sheath may or may not be bonded to the external tube wall.

A fuel pipe having these features has the capability of expanding its internal volume to accommodate pressure surges. When the tube walls move outward, compression of the rubber takes place and this assists in absorbing energy to avoid the

production of noise.

The tube is preferably of nylon. The sheath may be co-extruded with the tube and preferably has a foamed structure.

The sheath may be of a synthetic rubber.

Preferably the tube material is sufficiently resilient to allow it to be fitted over a conventional, circular section, fir-tree spigot to form a connection to the spigot in the same manner as a conventional circular tube.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of an engine fuel system;

Figures 2, 3 and 4 are cross-sections through alternative configurations of fuel pipe in a ccordance with the invention; and

Figure 5 illustrates how a fuel pipe in accordance with the invention can be fitted to a comnventional pipe fitting.

Figure 1 shows an engine 10 which is fed with fuel from a fuel tank 12. The engine is a fuel-injected engine, and fuel is delivered from the tank 12 along a delivery pipe 14 to a fuel rail 16, and excess fuel is returned to the tank along a return pipe 18. The delivery pipe includes a fuel feed pump 20 and a filter 22. These components may be mounted in the

tank, or may be outside the tank and connected in a section of plastic tubing 24. Where the delivery pipe passes beneath the underside of the vehicle, it may be formed by a section 26 of either steel or plastics tubing, and when the pipe enters the engine compartment, it is formed by a length of pipe 28 in accordance with the invention. The length of this section of pipe can for example be 0.5 m. Conventional connectors are used at 30 to connect the pipe sections 24, 26 and 28.

The pipe section 28 comprises a nylon tube 32 surrounded by a rubber-like (eg Santoprene - Registered Trade Mark) sheath 34. Figure 2 shows a tube 32a of generally triangular cross-section; Figure 3 shows a tube 32b of tri-lobal cross-section and Figure 4 shows a tube 32c of flat cross-section. In each case, the tube 32a, 32b, 32c is surrounded by a sheath 34 which has a circular external cross-section and is in contact with the external wall of the tube. The sheath may either be bonded or unbonded to the wall of the tube.

In use, when a pressure pulse or pressure surge occurs within the tube 32, the walls of the tube can flex outwards under the pressure to approach a circular configuration. For a given wall length, the space bounded by the wall will be a maximum when the wall is circular, and therefore the internal area (and thus the internal volume of a length of tube) of any of the tube cross-sections shown in Figures 2, 3 and 4 can be increased by this outward flexing of the the tube walls. Note that the tube walls do not have to stretch to achieve this increase in area; they only need to flex.

The sheath 34 around the tube will compress as a result of its rubber-like nature to absorb the energy which has to be

dissipated, but the external surface of the sheathe will not move or change shape, and thus there will be no external air movements which might give rise to undesirable noise.

If the tube 32 is of nylon, then it should be possible to stretch it so that it can fit over a conventional, circular, fir-tree fitting as shown at 36 in Figure 5 to provide the necessary seal. In Figure 5 the sheath 34 has been omitted for clarity. As a result, no special end fittings or end treatment are required for this tube.

The tube 32 can be produced by extrusion using conventional extrusion techniques. The sheath 34 can be co-extruded with the tube 32, or can be manufactured separately and then fitted over the tube.

The pipe 28 thus described provides a simple and particularly cost-effectvie manner for preventing pressure pulses in the fuel line from causing undesirable noise. Different engine installations may have different pressure pulse characteristics in the fuel line, and it would be possible to select the cross-sectional shape and wall thickness of the tube 32 as well as the wall thickness and nature of the sheath 34 in order to tune the pipe 28 to the particular application.

Because the outer surface of the tube 32 is unrestrained, the tube wall only needs to change its configuration, and not to stretch in any way, in order to accommodate the extra volume.

Claims

1. A fuel pipe for providing a fuel passage between a fuel tank and a fuel-consuming engine, the pipe comprising an extruded length of flexible plastics tube having a non-circular cross-section.

2. A fuel pipe as claimed in Claim 1, wherein a rubber or rubber-like sheath surrounds the tube and is in contact with the external tube wall.

3. A fuel pipe as claimed in Claim 1 or Claim 2, wherein the tube is of nylon.

4. A fuel pipe as claimed in any preceding claim, wherein the sheath is co-extruded with the tube.

5. A fuel pipe as claimed in any preceding claim, wherein the sheath has a foamed structure.

6. A fuel pipe as claimed in any preceding claim, wherein the sheath is of a synthetic rubber.

7. A fuel pipe as claimed in any preceding claim, wherein the tube material is sufficiently resilient to allow it to be fitted over a conventional, circular section, fir-tree spigot to form a connection to the spigot in the same manner as a conventional circular tube.

8. A fuel pipe substantially as herein described with reference to any one embodiment shown in the accompanying drawings.

Patents Act 1977

Examiner's report to the Comptroller under section 17 (The Search Report)

Application number 9207200.8

Relevant Technical fields

(i) UK Cl (Edition K) F2P (PC1, PC9, PF4, PF5, PF10) (PC3, PF23, PF30)

(ii) Int CL (Edition 5) F16L (9/12, 11/12, 55/02, 55/04) F15D 1/02

Search Examiner: B J PROCTOR

Databases (see over)

(i) UK Patent Office

(ii) ON-LINE DATABASE WPI

Date of Search: 10 JUNE 1992

Documents considered relevant following a search in respect of claims 1-7

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1292810	(U.K.E.A.) Eg Figures 2, 3, page 4 lines 13-14	1
Y	GB 1076819	(FORD) Eg page 1 lines 54-60	1, 3, 7
X	GB 1031396	(CONTINENTAL) Eg Figure 3	1, 2, 6
X	EP 0154104 A2	(MEDIPLAST) Eg Figure 2, page 3 lines 1-10	1
X	WO 8404574 A1	(ENITOR) Eg Figure 4, page 2 lines 1-7, page 4 lines 1-7	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

Published 1993 at The Patent Office, Concept House, Cardiff Road, Newport, Gwent NP9 1RH. Further copies may be obtained from Sales Branch, Unit 6, Nine Mile Point, Cwmfelinfach, Cross Keys, Newport, NP1 7HZ. Printed by Multiplex techniques ltd, St Mary Cray, Kent.